Energy demand modelling

Introduction to the PhD project

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Energy Demand Modelling

Introduction to the PhD project

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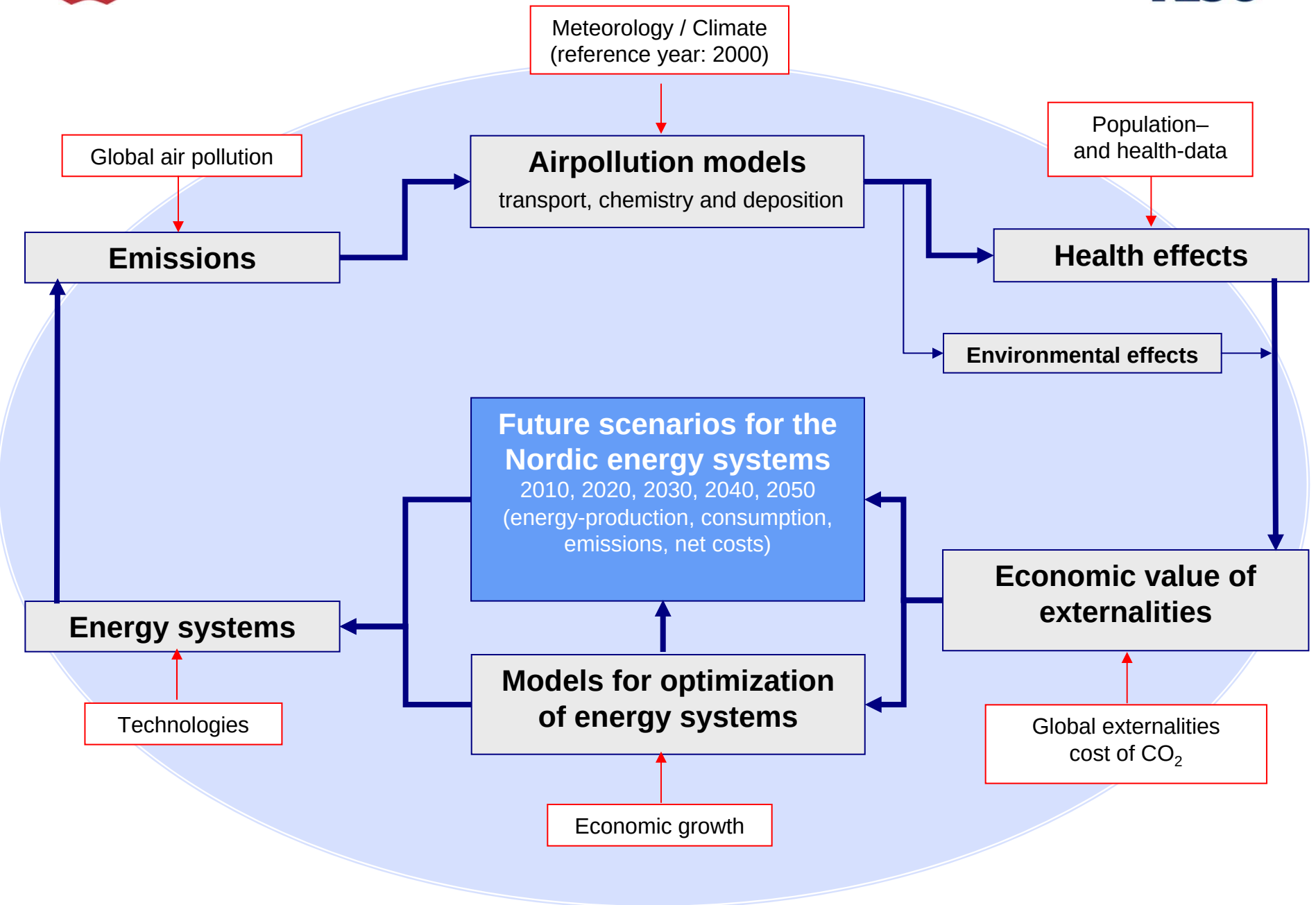
Energy Demand Model – endogenous part of a larger optimisation chain



Energy Demand Modelling - goals

Focus on health effects and related costs

- to associate different energy end uses and technologies with effects on human health and other externalities
- to develop energy demand optimisation model with focus on human health and with detailed representation of energy-efficiency technologies and microeconomic decision making
- to expand model to include macroeconomic feedbacks and perform energy policy analysis

Energy Demand Modelling - scope

- geographical scope – northern Europe: Denmark, Sweden, Norway, Finland and Germany
  - city or rural area

- sectors and consumer groups – different decision criteria
  - residential
  - business: trade & service, industry and agriculture
  - transport

- detail level – energy use processes and technologies (depends on information availability in different countries)

- energy forms: heat, electricity, transport fuels (e.g. hydrogen), other fuels

- time horizon – 2010, 2020, 2030, 2040, 2050

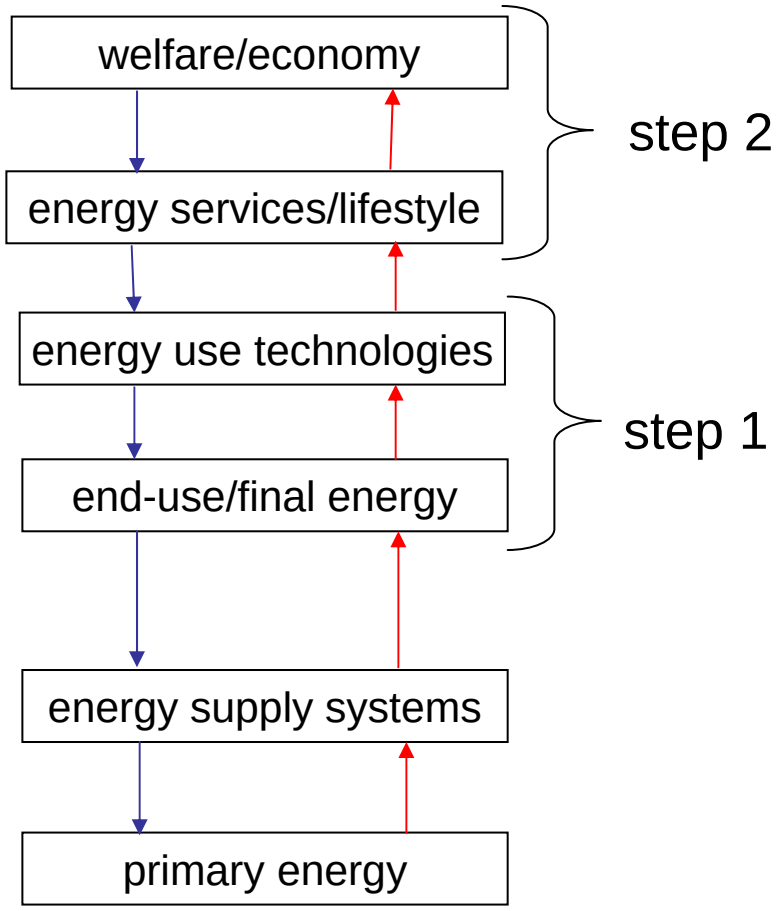
Energy Demand Modelling – stepwise

Step 1: to develop a **technology rich energy demand optimisation model** for minimising total energy system cost
-technologies compete on the basis of life cycle and externality costs

Step 2: to analyse and model **consumer behaviour** more
- criteria for choosing energy use technologies
- implementing other energy efficiency measures
-demand response – to changing energy production profiles
-lifestyle and demand for energy services

identified consumer behaviour is an input to policy suggestions

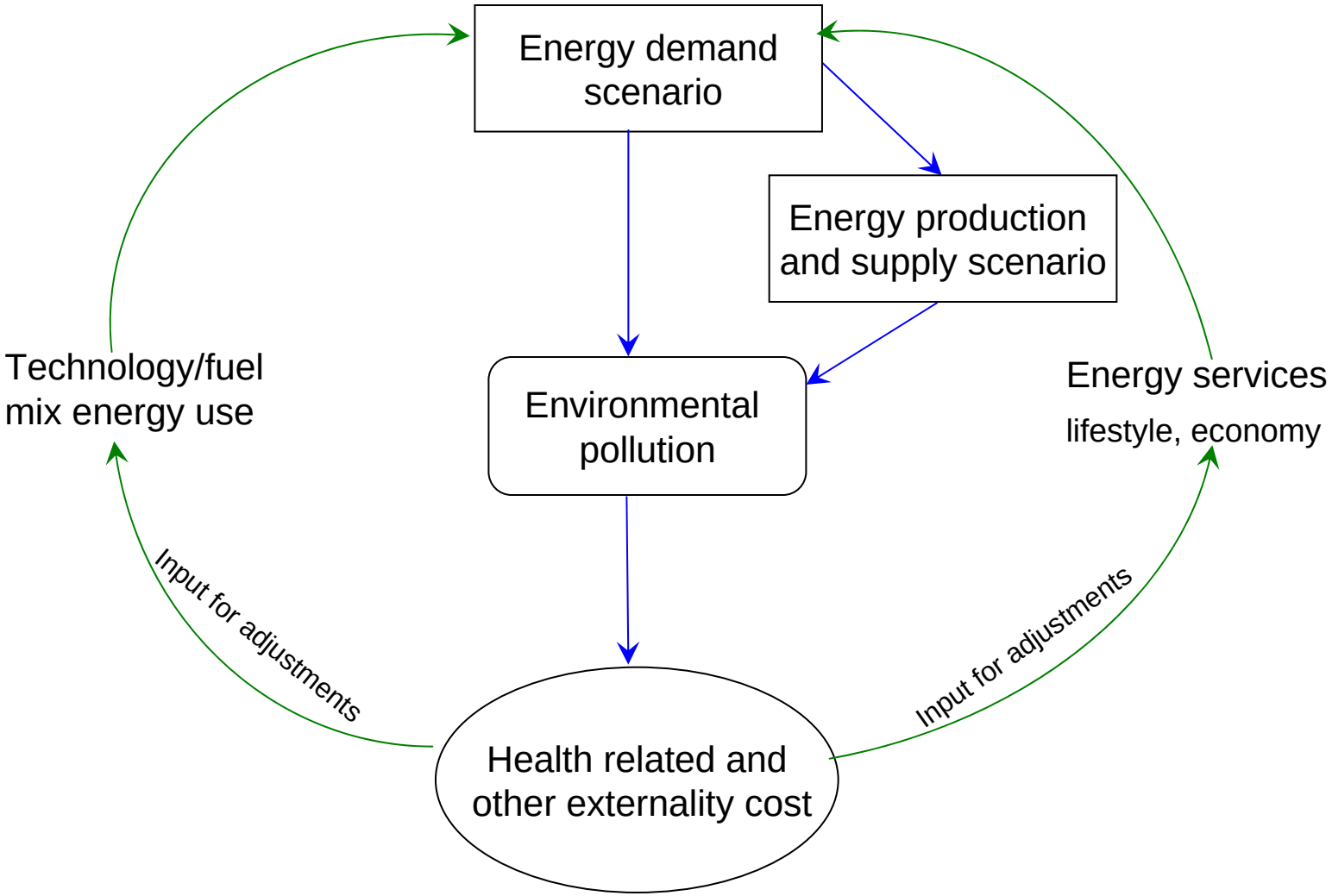
Step 3: expand model to include **macroeconomic equilibrium feedbacks** and perform **energy policy analysis**



The energy chain

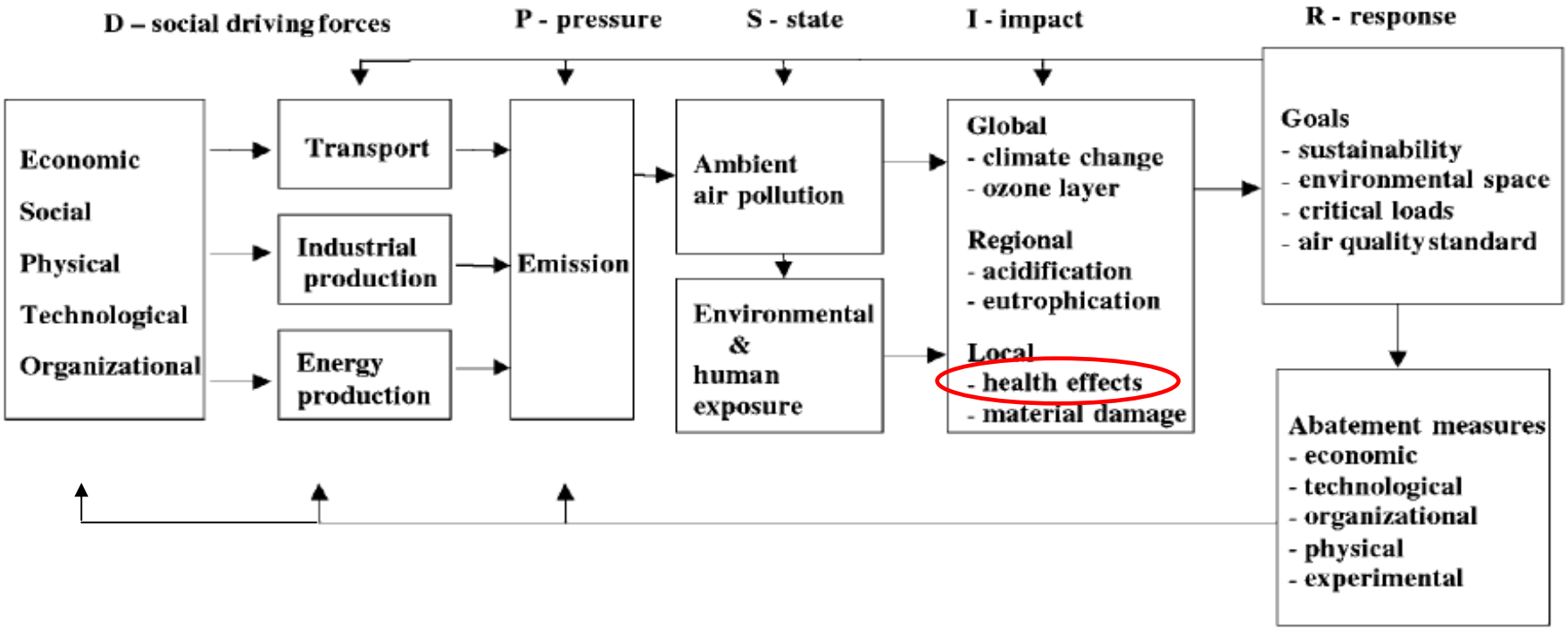
based on J.S Nørgård

Energy demand optimisation process



based on Jørgen S. Nørgård, 2000

The chain in air pollution-health effects



Hertel et al., 2001 *Human exposure to outdoor air pollution*

Focus on health related costs in energy demand modelling

- energy use & technologies and health impacts
  - direct impact – transport, individual residential heating – polluting at the places with high human exposure
  - indirect impact – district heating, use of electricity – through energy production

- Factors of air-pollution impact to human health
  - type of pollutants (depends on energy use, technology and fuel)
  - dispersion, concentration, exposure – city or rural area
  - population group exposed: elderly, children, ill, (consider their location?)

location – consumption rate – technology – energy type

Thank you!

Questions or suggestions?